



KENNEDY SPACE CENTER'S
SPACEPORT
m a g a z i n e

**YEAR ENDS
WITH LAUNCH
OF SPACEX
DRAGON TO
STATION**

2018 THE YEAR AHEAD

THE YEAR IN REVIEW **2017**

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For the latest on upcoming launches, check out NASA's Launches and Landings Schedule at

www.nasa.gov/launchschedule.

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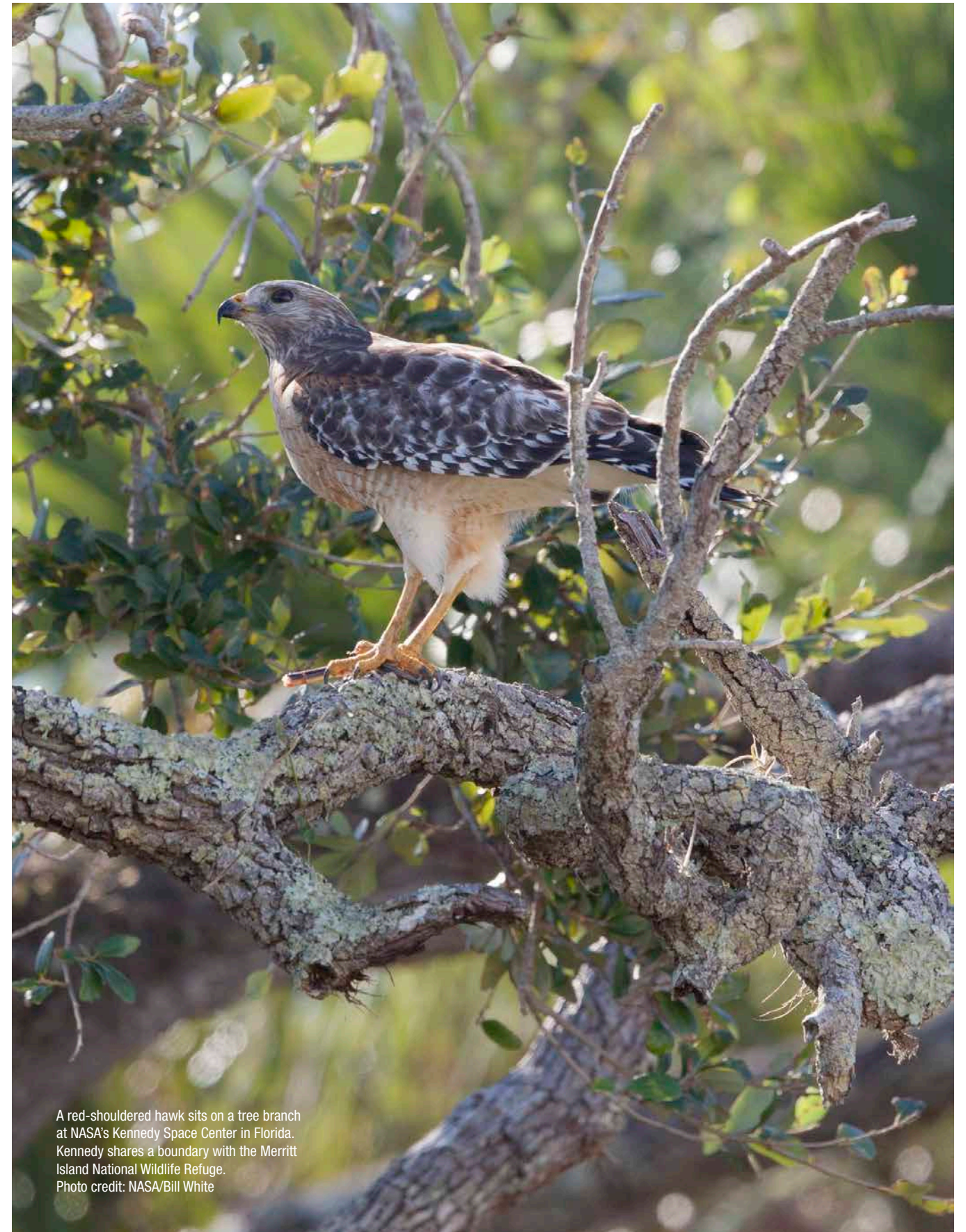
Cover: The SpaceX Falcon 9 rocket and Dragon spacecraft lift off from Space Launch Complex 40 at Cape Canaveral Air Force Station on the company's 13th cargo resupply mission to the International Space Station. Photo credit: NASA/Tony Gray and Sandra Joseph

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A red-shouldered hawk sits on a tree branch at NASA's Kennedy Space Center in Florida. Kennedy shares a boundary with the Merritt Island National Wildlife Refuge. Photo credit: NASA/Bill White

SOARING START

SpaceX Falcon boosts Dragon on mission to resupply International Space Station

BY LINDA HERRIDGE

A 4,800-pound care package was delivered to the International Space Station aboard a SpaceX Dragon spacecraft following a successful launch and two-day pursuit of the orbiting laboratory. The company's 13th commercial cargo mission to resupply the space station began Dec. 15 at 10:36 a.m. EST with liftoff aboard a SpaceX Falcon 9 rocket from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida.

After a successful climb into space, the Dragon spacecraft reached orbit and deployed its power-generating solar arrays. The rocket's first stage flew back for a successful landing at SpaceX's Landing Zone One at Cape Canaveral Air Force Station.

"This was a fantastic way to end the year for SpaceX east coast launches," said Jessica Jensen, director, Dragon Mission Management with SpaceX. "It was a great launch."

Loaded aboard the Dragon spacecraft were science, research, crew supplies and hardware for the orbiting laboratory. Science experiments include the Total and Spectral Irradiance Sensor (TSIS-1) that will measure the Sun's energy input to Earth, the Space Debris Sensor (SDS) that will directly measure the orbital debris environment around the space station for two to three years, and the Advanced Colloids Experiment-Temperature 7 (ACE-T-7) investigation, which involves the design and assembly of 3-D structures from small particles suspended in a fluid medium, structures that are vital to the design of advanced optical materials and electronic devices.

Read more at [go.nasa.gov/2mMUdSY](https://www.nasa.gov/2mMUdSY).

Station astronauts Mark Vande Hei and Joe Acaba captured the Dragon using the space station's robotic arm and then installed it on the station's Harmony module. The Dragon is slated to spend about a month at the station before returning to Earth in mid-January with results of previous experiments.



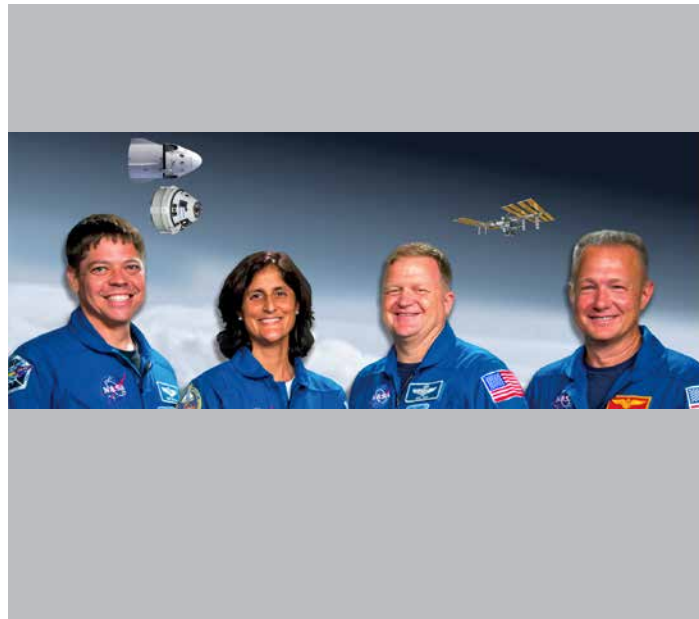
The two-stage SpaceX Falcon 9 rockets away from Space Launch Complex 40 at Cape Canaveral Air Force Station. Liftoff of the company's 13th cargo resupply mission to the International Space Station occurred Dec. 15 at 10:36 a.m. EST. Photo credit: NASA/Kim Shiflett



After boosting a SpaceX Dragon spacecraft on its way to the International Space Station, the Falcon 9 first stage returns to Landing Zone 1 at Cape Canaveral Air Force Station. Photo credit: NASA/Kim Shiflett

2017 THE YEAR IN REVIEW

2017 J A N U A R Y



Crew Rotation Missions Secured

NASA's Commercial Crew Program started the year by announcing four additional crew rotation missions from Boeing and SpaceX. The missions will carry astronauts to and from the International Space Station through 2024. The four additional missions fall under the Commercial Crew Transportation Capability contracts and bring the total number of crew rotation missions awarded to each provider to six. The missions will fly following NASA certification.

2017 J A N U A R Y



Core Stage Forward Skirt Umbilical Tested

NASA reached the halfway point on testing of the launch umbilicals for its Space Launch System rocket and Orion spacecraft at the Launch Equipment Test Facility. The Core Stage Forward Skirt Umbilical underwent testing for four months. A team of engineers and technicians with the Engineering Directorate and Ground Systems Development and Operations Program, along with support contractors, conducted the tests.

2017 J A N U A R Y



Orion Crew Module Moved for Proof Pressure Test

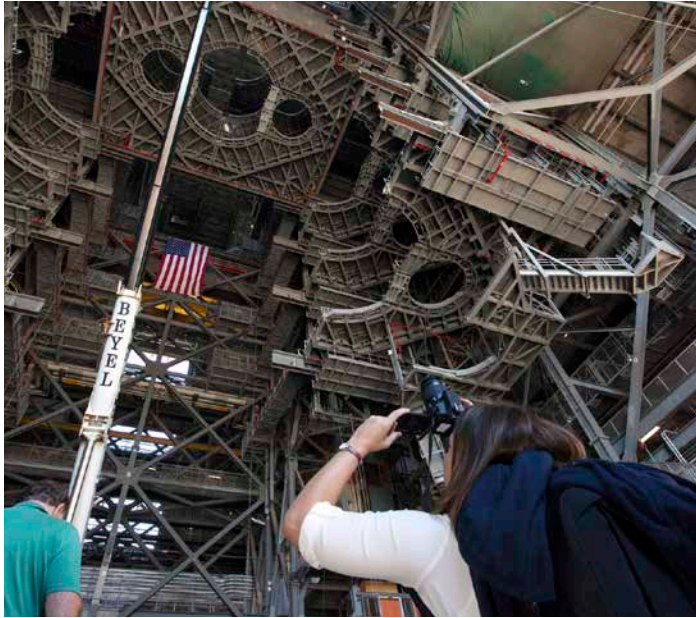
Welding of propulsion and Environmental Control and Life Support Systems tubing on the Orion crew module was completed and the spacecraft was moved from a clean room to the proof pressure cell in the high bay of the Neil Armstrong Operations and Checkout Building (O&C) Building.

2017 J A N U A R Y



Boeing Unveiled Spacesuit

Boeing unveiled the company's new, blue spacesuit astronauts will wear while aboard the Starliner. Designed to meet NASA's safety and functionality requirements, the suit weighs about 20 pounds and uses advanced materials, new joint patterns and zippers that make the suit light and flexible.



New Platform Installation Completed in Vehicle Assembly Building

Installation of 10 levels of new work platforms was completed inside High Bay 3 of the Vehicle Assembly Building. Work to install the platforms came to a conclusion as the final work platform, A north, was lifted, installed and secured on its rail beam on the north wall of the high bay inside the iconic facility.



First Solid Rocket Booster Forward Skirt Arrived

The forward skirt for the left-hand solid rocket booster of NASA's Space Launch System (SLS) rocket arrived at Cape Canaveral Air Force Station from booster prime contractor Orbital ATK's facilities in Promontory, Utah. The left-hand forward skirt was transported to Hangar AF where it continued refurbishment to support the first uncrewed flight test of the Orion spacecraft atop the SLS rocket.



First Commercial Liftoff from Launch Complex 39A

SpaceX launched its 10th commercial resupply services mission for NASA for the first time from Launch Complex 39A. The company's Falcon 9 rocket lifted off from the modified pad A and carried the Dragon module, loaded with supplies, equipment and science experiments, to the International Space Station.



Interim Cryogenic Propulsion Stage Arrived

The first integrated piece of flight hardware for NASA's Space Launch System rocket, the Interim Cryogenic Propulsion Stage (ICPS) arrived at Cape Canaveral Air Force Station. It was shipped from the United Launch Alliance facility in Decatur, Alabama, aboard the Mariner barge.



First Umbilical Installed on Mobile Launcher for Space Launch System and Orion

The first launch umbilical for NASA’s Space Launch System and Orion spacecraft was installed on the mobile launcher tower. The Orion Service Module Umbilical (OSMU) was installed high up on the tower at about the 260-foot level. The OSMU will connect to the Orion service module and transfer liquid coolant and purge air/GN2 for environmental control.



Pneumatic Systems Tested on Orion Crew Module

Testing of systems critical to preparing Orion for its first flight atop NASA’s Space Launch System rocket was successfully completed in the Multi-Payload Processing Facility. The facility is where fuel and commodities will be provided for the Orion spacecraft prior to launch.



Orbital ATK Launched Seventh Commercial Resupply Services Mission

Orbital ATK’s seventh commercial resupply mission for NASA launched atop a United Launch Alliance Atlas V rocket from Space Launch Complex 41 at Cape Canaveral Air Force Station. Orbital’s Cygnus spacecraft delivered supplies, equipment and science experiments to the International Space Station.



Boeing Starliner Powered Up

Inside Boeing’s Commercial Crew and Cargo Processing Facility, the “Spacecraft 1,” as the individual Starliner is known, was powered up for the first time. It is being assembled for use during a pad abort test that will demonstrate the Starliners’ ability to lift astronauts out of danger in the unlikely event of an emergency. Later flight tests will demonstrate Starliners in orbital missions to the station without a crew, and then with astronauts aboard.



Orion Crew Module Underwent Tank Welding

Engineers and technicians completed the welding of the tanks to the propulsion and Environmental Control and Life Support Systems (ECLSS) tubing in a clean room in the O&C high bay. Welding also was completed to install the propellant, pressurant and post-landing coolant tanks. The pressurant is used to maintain the flow of propellant and coolant in the propulsion and ECLSS systems, respectively.



Final Brick Installed in Launch Complex 39B Flame Trench

The final heat-resistant brick was installed on the north side of the flame trench below the surface of the pad. During a year's worth of work, 96,000 heat-resistant bricks, in three different sizes, were secured to the walls using bonding mortar in combination with adhesive anchors.



Kennedy Space Center Earned Voluntary Protection Program Star

The center earned the Voluntary Protection Program (VPP) Star from the Occupational Safety and Health Administration (OSHA). It is OSHA's highest honor, and Kennedy has held the Star rating each year since 2004.



SpaceX Launched 11th Commercial Resupply Mission

SpaceX launched a Falcon 9 rocket on the company's 11th commercial resupply services mission for NASA from Launch Complex 39A. The SpaceX Dragon cargo module atop carried supplies, equipment and science experiments to the International Space Station.



SpaceX Completed Joint Recovery Trainer Exercises

SpaceX, NASA and U.S. Air Force personnel completed full-scale joint recovery trainer exercises to prepare for and ensure crew safety in the unlikely event of a rescue scenario. The Rescue Trainer, a full-size model of the spacecraft, was lowered into the Indian River Lagoon near the center so that Air Force pararescuers and others could learn techniques for quickly reaching the spacecraft and supporting the astronauts aboard. SpaceX followed up the rescue and recovery testing in the Atlantic Ocean with spacesuit-clad astronauts and personnel who will assist upon return to Earth.



Turn Basin Prepped for Space Launch System Core Stage Arrival

The dock area that was used for arrival and offloading of space shuttle external tanks received a makeover to accommodate the Space Launch System's larger and heavier core stage when it arrives aboard NASA's modified barge Pegasus.



Vice President Mike Pence Visited Kennedy

Speaking before an audience of NASA leaders, U.S. and Florida government officials, and employees inside the Vehicle Assembly Building, Vice President Mike Pence thanked the Kennedy workforce for advancing American leadership in space. During his visit, the Vice President also toured facilities highlighting public-private partnerships as both NASA and commercial companies prepare to launch American astronauts from the multi-user spaceport.



Interim Cryogenic Propulsion Stage Moved to Space Station Processing Facility

The Interim Cryogenic Propulsion Stage for NASA's Space Launch System rocket arrived at Kennedy Space Center. It was transported from the United Launch Alliance facility at Cape Canaveral Air Force Station, where it underwent final testing and checkout, to the Space Station Processing Facility.



Core Stage Forward Skirt Umbilical Installed on Mobile Launcher

The Core Stage Forward Skirt Umbilical (CSFSU) was installed on the tower of the mobile launcher. The CSFSU will swing into position to provide connections to the Space Launch System core stage forward skirt, and then swing away before launch. It will provide conditioned air and gaseous nitrogen to the core stage forward skirt cavity.



Booster Engine Service Platforms Delivered

New service platforms for the Space Launch System's booster engines arrived at Kennedy Space Center. The platforms will be used for processing and checkout of the engines for the rocket's twin five-segment solid rocket boosters for Exploration Mission-1.



TDRS-M Launched into Earth Orbit

The Tracking and Data Relay Satellite-M (TDRS-M) spacecraft launched from Space Launch Complex 41 at Cape Canaveral Air Force Station in Florida on August 18 at 8:29 a.m. EDT atop an Atlas V rocket. TDRS-M will replenish NASA's Space Network and provide the ability to support space communication for an additional 15 years. The network consists of TDRS satellites that transmit data to and from ground stations on Earth for NASA missions and expendable launch vehicles.



Orion Spacecraft Powered Up

The Orion spacecraft for Exploration Mission-1 was successfully powered up for the first time in the O&C to ensure everything performs as planned during its uncrewed flight test atop NASA's Space Launch System rocket.



SpaceX Launched 12th Commercial Resupply Mission

SpaceX launched its Falcon 9 rocket and Dragon cargo spacecraft on the company's 12th commercial resupply services mission to the International Space Station. The Dragon was filled with equipment, supplies and science experiments for delivery to the space station.



SpaceX Unveiled New Spacesuit

SpaceX unveiled the first look at its new spacesuit design that astronauts flying to and from the International Space Station will wear inside the Crew Dragon spacecraft. Suit testing is underway to ensure the suit performs as designed. NASA astronauts have been doing spacesuit fit checks and other testing to prepare for missions, including the first pressurized spacesuit tests using NASA astronauts.



Liquid Oxygen Tanking Operations Began at Launch Pad 39B

The first major integration at Launch Pad 39B began with the initial tanking of a cryogenic fuel into a giant sphere at the northwest corner of the pad. Several Praxair trucks arrived and offloaded liquid oxygen (LO2) into the giant sphere, which can hold about 900,000 gallons of LO2.



Orion Heat Shield Moved to Thermal Chamber

The heat shield for Orion's Exploration Mission-1 test flight was moved into the O&C thermal chamber to undergo a thermal cycle test. The test verified that the heat shield's thermal protection systems were manufactured and assembled correctly.



Orion Crew Access Arm Arrived at Kennedy Space Center

The crew access arm that astronauts will walk across to board the Orion spacecraft arrived at Kennedy Space Center and was placed on a work stand in a storage location at the center. The access arm was transported from Precision Fabricating and Cleaning in Cocoa, Florida, where it was designed and manufactured.



Core State Inter-Tank Umbilical Fit Checked on Mobile Launcher

The Core Stage Inter-Tank Umbilical was lifted up to about the 140-foot level of the mobile launcher tower for a fit check of the attachment hardware. The swing-arm umbilical will connect to the Space Launch System core stage inter-tank and provide conditioned air, pressurized gases and power and data connections.



Plants Harvested, New Plant Habitat Installed on Space Station

For the first time, three different plant varieties were simultaneously grown in the Veggie chamber aboard the International Space Station. A new plant growth chamber, called the Advanced Plant Habitat, was installed into an EXPRESS rack in the Japanese Experiment Module Kibo.



Joint Polar Satellite System-1 Launched

NOAA's Joint Polar Satellite System-1 (JPSS-1) launched aboard a Delta II rocket from Space Launch Complex-2W at Vandenberg Air Force Base in California on Nov. 18. JPSS is the nation's advanced series of polar-orbiting environmental satellites. JPSS represents significant technological and scientific advancements in observations used for severe weather prediction and environmental monitoring. This data is critical to the timeliness and accuracy of forecasts three to seven days in advance of a severe weather event. JPSS is a collaborative effort between NOAA and NASA.



Orion Crew Module Moved to Thermal Chamber

The Orion crew module for Exploration Mission-1 was moved into the O&C thermal chamber. The crew module underwent a thermal cycle test to verify acceptable workmanship and material quality.



Interim Cryogenic Propulsion Stage Transferred to EGS

The first piece of Space Launch System hardware, the Interim Cryogenic Propulsion Stage, was transferred from NASA's Spacecraft/Payload Integration and Evolution organization to Exploration Ground Systems (EGS) at Kennedy Space Center.



Sierra Nevada Corp. Completed Free Flight Test

Sierra Nevada Corp.'s Dream Chaser spacecraft glided to a successful landing at NASA's Armstrong Flight Research Center located on Edwards Air Force Base in California. Completion of Dream Chaser's free flight test on Nov. 11 was a major milestone under a Space Act Agreement with NASA's Commercial Crew Program.



Orion Crew Access Arm Transported to Mobile Launcher

The Orion crew access arm was transported from its storage location to the mobile launcher. It will be installed at about the 274-foot level on the mobile launcher tower.



SpaceX Launched 13th Commercial Resupply Mission

SpaceX launched its Falcon 9 rocket and Dragon cargo spacecraft from Space Launch Complex 40 at Cape Canaveral Air Force Station on the company's 13th commercial resupply services mission to the International Space Station. The Dragon carried 4,800 pounds of equipment, supplies and science experiments for delivery to the orbiting laboratory.



Water Flowed During a Test at Launch Pad 39B

About 450,000 gallons of water flowed at high speed from a holding tank through new and modified piping and valves, the flame trench, flame deflector nozzles and mobile launcher interface risers during a wet flow test at Launch Pad 39B. At peak flow, the water reached about 100 feet in the air above the pad surface. The test was a milestone to confirm and baseline the performance of the Ignition Overpressure/Sound Suppression system.



Launch Complex 39 surrounding areas are seen during an aerial survey of NASA's Kennedy Space Center in Florida on September 12, 2017. Photo credit: NASA/Bill White

2018 THE YEAR AHEAD →

2018 THE YEAR AHEAD

Orion Underway Recovery Test

Exploration Ground Systems engineers and Navy divers will test the procedures that will be used to safely recover the Orion capsule after splashdown in the Pacific Ocean for Exploration Mission-1 and, later, to recover both capsule and crew following Exploration Mission-2.

EM-1 Orion Stage Adapter Delivered*

The Orion stage adapter for Exploration Mission-1 will be delivered to Kennedy aboard a Guppy cargo aircraft. This will be the second piece of Space Launch System hardware to arrive at the Florida spaceport.

GOES-S Launch

Launching on a United Launch Alliance Atlas V rocket, NOAA's Geostationary Operational Environmental Satellite-S (GOES-S) will be the second in a series of next-generation environmental-monitoring satellites.

TESS Launch

NASA's Transiting Exoplanet Survey Satellite (TESS) is an all-sky survey mission that will discover exoplanets around nearby bright stars. TESS is scheduled to launch aboard a SpaceX Falcon 9 rocket.

Orion Heat Shield Installation Complete

The Orion heat shield for Exploration Mission-1 will be installed on the crew module.

SpaceX CRS-14 Launch

Launch of the SpaceX Falcon 9 rocket and Dragon spacecraft will mark the company's 14th commercial resupply services mission to the International Space Station.

SpaceX DM-1

SpaceX's Demonstration Mission-1 will be an uncrewed mission to the International Space Station.

Mobile Launcher Rolls to Launch Pad

The Mobile Launcher will roll to Pad 39B in preparation for a fit check.

InSight Launch

Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight), the first mission to explore Mars' deep interior, is scheduled to launch on a United Launch Alliance Atlas V rocket.

GRACE-FO Launch

NASA's Launch Services Program, based at Kennedy, serves in an advisory role for Gravity Recovery and Climate Experiment Follow-on (GRACE-FO). It is scheduled to launch as part of an Iridium commercial satellite launch on a SpaceX Falcon 9.

Orion Active Jettison Motor Delivered

The active jettison motor for Exploration Mission-1 will be delivered to Kennedy.

Orion Crew Module Adapter Functional Testing Complete

Functional testing of the Orion Crew Module Adapter will be completed.

SpaceX CRS-15 Launch

Launch of the SpaceX Falcon 9 rocket and Dragon spacecraft will mark the company's 15th commercial resupply services mission to the International Space Station.

EM-1 Launch Vehicle Stage Adapter Delivered*

The delivery of the Exploration Mission-1 Launch Vehicle Stage Adapter (LVSA) to the Exploration Ground Systems Program at Kennedy will represent the largest piece of hardware to date delivered to the Florida spaceport.

SCCS 4.1 Software Complete

Development of the communication and control software to support Exploration Mission-1 will be complete.

Parker Solar Probe Launch

Parker Solar Probe will swoop to within four million miles of the sun's surface, facing unprecedented heat and radiation as it collects solar activity data and makes critical contributions to our ability to forecast space-weather events.

ICESat-2 Launch

Ice, Cloud, and Land Elevation Satellite-2 (ICESat-2) will measure the height of a changing Earth, one laser pulse at a time. ICESat-2 will allow scientists to measure the elevation of ice sheets, glaciers, sea ice and more.

Orion European Service Module Arrival

European Service Module is expected to arrive at Kennedy to begin final round of testing and readiness for Exploration Mission-1.

Liquid Hydrogen Storage Tank Construction Begins

Construction begins on the liquid hydrogen storage tank at Launch Pad 39B.

Exploration Upper Stage Umbilical Fabrication Begins

Fabrication begins on the Space Launch System Exploration Upper Stage forward and aft umbilicals.

Boeing OFT

Boeing's Orbital Flight Test will be an uncrewed mission to the International Space Station.

SpaceX DM-2

SpaceX's Demonstration Mission 2 will be a crewed mission to the International Space Station.

Orion European Service Module Initial Power-On

European Service Module will go through initial power-on testing to ensure necessary components are working and ready to undergo further testing.

Orion Crew Module Completes Readiness to Mate to Service Module

Orion Crew Module will have completed necessary procedures and will be qualified as ready to mate to the European Service Module.

EM-1 Booster Motor Segments Delivered to Kennedy*

The Exploration Mission-1 booster motor segments will be delivered to Kennedy by train. Once they arrive they will be offloaded and begin processing in Kennedy's Rotation, Processing and Surge Facility.

Orion Crew Module/ European Service Module Mating Begins

The Orion Crew Module and the European Service Module will begin the process of mating to undergo further tests before the launch of Exploration Mission-1.

Boeing CFT

Boeing's Crew Flight Test will be a crewed mission to the International Space Station.

SpaceX CRS-16 Launch

Launch of the SpaceX Falcon 9 and Dragon spacecraft will mark the company's 16th commercial resupply services mission to the International Space Station.

Orion Crew Module and European Service Module Official Power-On

Once mated, the Orion Crew Module and European Service Module will undergo power-on testing to ensure all connections and needed hardware are responsive.

Orion Launch Abort System and Ogive Available for Exploration Ground Systems

The Launch Abort System and Ogive will be handed over to Exploration Ground Systems to begin assembly in preparation for Ascent Abort-2.



*Kennedy Space Center is supporting the Space Launch System Program, which is based at NASA's Marshall Space Flight Center in Huntsville, Alabama.

AMERICAN HERO

Robert Lawrence honored in 50th anniversary memorial ceremony

BY BOB GRANATH

NASA leaders and the **Astronauts Memorial Foundation** (AMF) recently paused to honor U.S. Air Force Maj. Robert Lawrence, the first African-American astronaut. He lost his life in a training accident 50 years ago.

The ceremony took place in the Center for Space Education at the Kennedy Space Center Visitor Complex. The observance was hosted by the AMF, which pays tribute to those who died advancing the cause of space exploration.

“Maj. Lawrence truly was a hero,” said, Kennedy Director Bob Cabana, who also was a space shuttle astronaut. “He took that first step setting the stage for what was to come.”

The memorial tribute included remarks by former NASA Administrator Charlie Bolden, the first African-American to serve in the agency’s top position.

“His leadership was recognized early,” said Bolden, who also was a NASA astronaut. “In his days in the Air Force ROTC Program at Bradley University, he was selected as a cadet commander.”

Lawrence’s sister, Barbara Lawrence, Ph.D., spoke of the closeness of her family and the values that were instilled in them.

“Your word is your bond and you do what you say you are going to do,” she said.

Also participating in the ceremony were Eileen Collins, chair of the AMF board of directors and a former NASA astronaut; Bob Crippen, former Kennedy center director and NASA astronaut; and physicist Herman White, Ph.D. Also speaking was James Abrahamson, a retired U.S. Air Force lieutenant general who also was a **Manned Orbiting Laboratory** (MOL) astronaut. He later was associate administrator of NASA and served as director of the Strategic Defense Initiative. A presentation to the AMF was made from Lawrence’s fraternity, Omega Psi Phi, by the organization’s grand basileus, Antonio “Tony” Knox.

Lawrence was selected as a U.S. Air Force astronaut on June 30, 1967, and was among those designated to fly aboard the MOL. The military program, which was cancelled in 1969, involved a small, single-use space station in which crews would launch and land in an advanced **Gemini** spacecraft.

A Chicago native, Lawrence graduated from high school in 1952 when he was only 16. By the age of 20 he earned a bachelor’s degree



Selected in 1967 for the Manned Orbiting Laboratory Program, U.S. Air Force Maj. Robert Lawrence was America’s first African-American astronaut. Photo credit: U.S. Air Force

in chemistry from Bradley University in Peoria, Illinois. A year later he became a pilot in the U.S. Air Force after completing flight training at Malden Air Force Base, Missouri. Lawrence went on to earn a doctorate in physical chemistry from Ohio State University in 1965.

As a test pilot, Lawrence often flew the F-104 Starfighter to investigate the gliding flight of various unpowered spacecraft returning to Earth from orbit. The research contributed to the experimental operations of the X-15 and the development of the space shuttle.

Six months after his selection as an astronaut for the MOL Program, Lawrence was killed in an F-104 crash during a training accident on Dec 8, 1967, at Edwards Air Force Base, California. He was flying backseat on the mission as the instructor pilot for a flight test trainee learning the steep-descent glide technique.

“He was involved in development of the maneuver that would become a critical part of space shuttle landing techniques called ‘flare,’” Bolden said.

When the MOL was cancelled in 1969, seven of the 16 Air Force, Navy and Marine Corps astronauts selected for the program



Kennedy Space Center Director Bob Cabana speaks during an Astronauts Memorial Foundation tribute honoring U.S. Air Force Maj. Robert Lawrence. Those listening in the front row include former NASA administrator Charlie Bolden. The ceremony took place in the Center for Space Education at the Kennedy Space Center Visitor Complex. Photo credit: NASA/Kim Shiflett



who were under the age of 35 transferred to NASA. All flew space shuttle missions.

Had he lived, Lawrence “would have been one of the MOL astronauts who came to NASA,” Cabana said.

Lawrence’s name was added to the AMF’s **Space Mirror Memorial** at the Kennedy visitor complex during a ceremony on Dec. 8, 1997.

The Space Mirror Memorial was dedicated in 1991 to honor the lives of those who died while serving in America’s space programs. At the time of Lawrence’s death, the Air Force policy required a flight in space before the award of the astronaut rating. However, on Jan. 2, 1997, the Astronaut Memorial Foundation made a formal request for the Air Force to reconsider Lawrence’s case. In light of the importance of his selection and the unfortunate circumstances of his death, the Air Force retroactively designated Lawrence an astronaut.

The AMF is a private, not-for-profit organization that honors and memorializes astronauts who sacrificed their lives for the nation and the space program. AMF built and maintains the Space Mirror Memorial and the Center for Space Education at the Kennedy visitor complex.

Left: Robert Lawrence prepares for a flight. Lawrence was killed on Dec. 8, 1967, in an F-104 crash during a training exercise at Edwards Air Force Base, California. Photo credit: U.S. Air Force

LOUD AND CLEAR!

“NASA on the Air” events to highlight key space milestones

BY BOB GRANATH

NASA is known for communicating with astronauts on missions to space, but regular citizens can radio NASA centers across the country. From the end of this year through the next, NASA will mark several key milestones. Amateur radio clubs at agency centers across the nation plan to celebrate these occasions with several “NASA on the Air” events.

“We enjoy sharing NASA’s story as part of the fun of making contact with fellow ham radio operators across the nation and around the world,” said Kevin Zari, who is activities officer for the **Amateur Radio Club** at NASA’s Kennedy Space Center. “We occasionally communicate with people who think that because we’re not flying the space shuttle anymore, NASA has almost gone out of business. We tell them about activities such as the International Space Station and the Space Launch System, and they appreciate the update.”

Amateur, or ham, radio operators use a frequency spectrum for communicating noncommercial and private messages. One of the most important uses of ham radio operations is providing emergency messaging following disasters, such as the recent Hurricane Maria that destroyed most avenues of communication in Puerto Rico.

“The amateur radio clubs at NASA centers are made up of civil servants, contractors and tenants who participate on their own time,” said Zari, who has been at Kennedy since 1990 and is chief



Amateur Radio Club members at NASA’s Kennedy Space Center, from left, Matthew Baker, David Crawford and Kevin Zari, participate in an on-the-air contact. On the back wall is a collection of QSL cards that ham radio enthusiasts exchange when contact is made with an operator at another location. Photo credit: Kennedy Space Center Amateur Radio Club

technology officer in the Mission and Support Office of Exploration Research and Technology Programs. “We all have a common goal to show our support for NASA and highlight some of the agency’s amazing accomplishments.”

Zari added that he hopes, if time permits, International Space Station astronauts can participate using ham radio equipment aboard the orbiting laboratory 225 miles above the Earth, made possible by the Amateur Radio on International Space Station (ARISS) Program. Amateur radio even has been part of NASA spaceflights since Shuttle Amateur Radio operations started in 1983.

The plan is to talk about these anniversaries and their place in the history of NASA, explains Rob Suggs, who is the secretary



Kennedy Space Center Amateur Radio Club members Dennis Veselka, left, and Scott Vangen are in the club’s facility, where members plan to participate in “NASA on the Air” events to celebrate agency historical milestones during the coming year. Photo credit: Kennedy Space Center Amateur Radio Club

of the amateur radio club at the Marshall Space Flight Center in Huntsville, Alabama.

“We also want people to know what we are doing now and what’s coming up in the near future,” he said. “This includes the Commercial Crew Program, as well as plans to send astronauts beyond low-Earth orbit with the Space Launch System and Orion.”

“We plan to publicize the “NASA on the Air” events in amateur radio magazines, on our Facebook site and webpage,” said Suggs who has worked for NASA since 1994 and is the Space Environments Team lead at Marshall.

Zari added that they plan to use the hashtag #NOTA when announcing events on Twitter (@NASARadioClubs).

While NASA amateur radio stations are commemorating historic



Working inside the Columbus laboratory of the International Space Station, NASA astronaut Reid Wiseman makes contacts with amateur radio operators during an Expedition 40 exercise on June 28, 2014. Photo credit: NASA

milestones, Zari explains they also are making it into a contest.

“Ham radio enthusiasts usually exchange QSL cards,” he said. “When you make contact with someone, you exchange a postcard noting the contact was made. For this yearlong event, some clubs at NASA centers are offering commemorative QSL cards and a special certificate indicating how many centers a participant contacted on various frequency bands.”

QSL cards serve as written confirmation of communication between amateur radio stations. QSL derived its name from the Q, or question, code message: “QSL?” It simply means, “Do you confirm receipt of my transmission?”

According to Suggs, points will be awarded to each center’s amateur radio club based on the number of contacts made during the yearlong event. Participants can enhance their award by using one of the existing capabilities of amateur radio on the space station, such as packet (digital operations) or listening in to an astronaut giving answers to school children during one of the scheduled school contacts. No special activity is planned from the station and only one activity from the space station is needed to qualify.

“We plan to have a web-based system for participants to check

their points total and download a printable certificate at the end of the event,” he said. “Points will be awarded for each center’s contacts.”

Learn more about the “NASA on the Air” events at: nasaontheair.wordpress.com

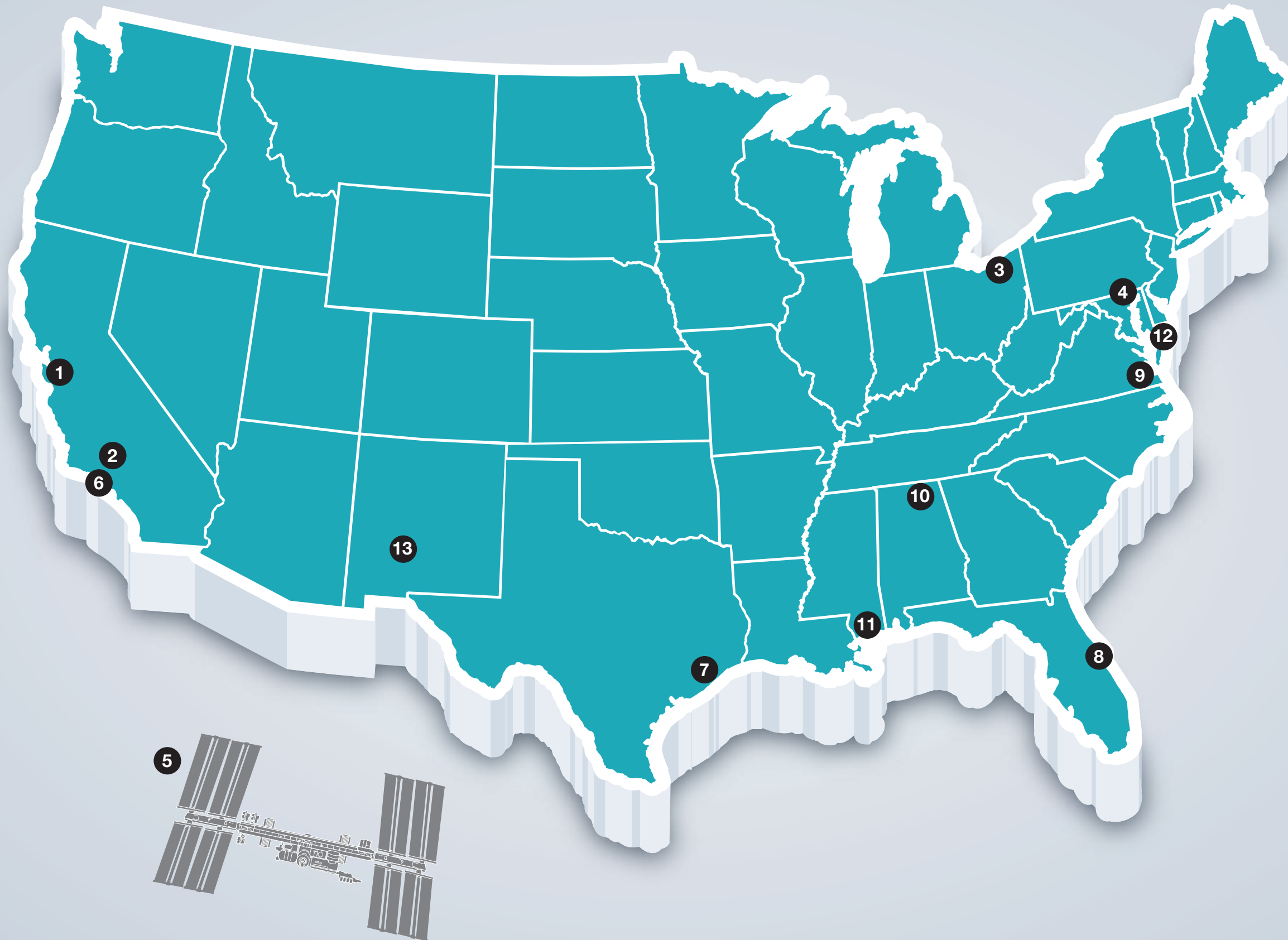
“NASA on the Air” Events

Milestones coming up between Dec. 11, 2017, and Dec. 27, 2018, will include:

- 45th anniversary of **Apollo 17**, Dec. 12-19, 1972
- 60th anniversary of the **establishment of NASA**, Oct. 1, 1958
- 20th anniversary of the launch of the first U.S. element of the International Space Station during **STS-88**, commanded by Kennedy’s Director Bob Cabana, Dec. 4-16, 1998
- 50th anniversary of **Apollo 8**, the flight of Frank Borman, Jim Lovell and Bill Anders to orbit the Moon, Dec. 21-27, 1968

NASA on the Air Stations

National Aeronautics and
Space Administration



1. Ames Research Center
NA6MF
2. Armstrong Flight Research Center
NA6SA
3. Glenn Research Center
NA8SA
4. Goddard Space Flight Center
WA3NAN
5. International Space Station
NA1SS
6. Jet Propulsion Laboratory
W6VIO
7. Johnson Space Center
W5RRR
8. Kennedy Space Center
N1KSC
9. Langley Research Center
KG4NJA
10. Marshall Space Flight Center
NN4SA
11. Stennis Space Center
TBD
12. Wallops Flight Facility
W4WFF
13. White Sands Complex
N5BL



National Aeronautics and
Space Administration



COMMERCIAL CREW PROGRAM

2018

Children's Artwork

CALENDAR

**COMMERCIAL CREW
2018 ARTWORK CALENDAR**

Keep track of 2018 with the new Commercial Crew Program 2018 Artwork Calendar! The calendar features works of art submitted by children ages four to 12 who've shared with us their fun and inspiring visions of the International Space Station, astronauts, growing food in space and more.

Learn more and download your own calendar at

go.nasa.gov/2ytxo7G.

SPACE STUDIES

Researcher gives insight to crash course



Michael Johansen, far right, and members of his Human Performance in Space team took part in crisis leadership training at the National Maritime College of Ireland. During the training, the team had to jump off a 25-foot platform into 60-degree-Fahrenheit water, where they were forced to solve problems. The purpose of the team-building exercise was to learn about one's physical limitations and recognize how cognitive abilities are impaired in high-stress situations. Photo credit: International Space University

We sat down with Kennedy's Michael Johansen to learn more about his experience at The International Space University's Space Studies Program.

What is your daily job at NASA?

I'm a research engineer in the Swamp Works innovation lab. I've worked on a diverse set of technologies since starting my career at NASA. I develop technologies needed for future planetary exploration missions.

When/where was the Space Studies Program?

International Space University's Space Studies Program is held at a different location every year. The 2017 summer session was held at the Cork Institute of Technology in Cork, Ireland, from June to August. There's also a Space Studies Southern Hemisphere Program that is held in Australia during the winter.

What is the Space Studies Program?

The Space Studies program is an international graduate-level professional program that includes the following courses: Space Applications, Engineering, Human Performance in Space, Humanities, Management and Business, Space Sciences, and Policy, Economics, and Law. Over the course of nine weeks, the participants complete core lectures, department activities and team projects related to these disciplines. It is a great opportunity to network with space-minded professionals from around the globe.

Why did you want to attend?

I try to take advantage of as many opportunities as I can. Several of my coworkers have completed the Space Studies Program and told me about this incredible, once-in-a-lifetime experience. The Space Studies Program is centered on "The Three I's": It is interdisciplinary, international and intercultural. I'm interested in learning about different cultures and learning outside of my area of expertise, so I thought it was a good fit for me.

What did you hope to take away?

I hoped to learn how to lead in a diverse environment, to gain new insight about different cultures and to gain knowledge in space-related subjects to which I haven't previously had exposure.

What was your experience like?

To sum it up in a few words, it was life-changing both personally and professionally. Never have I been in the room with people from so many different backgrounds. This year's program had 112 participants from 26 countries. There were engineers, scientists, entrepreneurs, doctors, artists, singers and so many other types. We learned a lot from the lectures and each other. I made connections with many other professionals in the space industry. I now have friends all over the world.

What did you enjoy the most?

I led an interdisciplinary team made up of 28 participants from 16 countries to develop alternate futures for the International Space Station. Over the course of nine weeks, we considered what to do with the ISS instead of deorbiting it in 2024. We interviewed astronauts and other key ISS personnel to learn about their experiences and to determine what should be improved on the ISS. We learned about various countries' plans for space exploration and determined how to better align the ISS with these goals. We considered the political and economic aspects of extending the life of the station. Overall, leading this effort was a great opportunity for me to grow as a leader and an engineer.

What advice would you give to future attendees?

Be prepared to work! While spending nine weeks living in a different country may sound like a vacation, I can assure you it's not. In just the first four weeks, we attended 63 lectures, took two exams and attended many workshops and panel discussions. As time goes on, you spend more time working on your team project. And less time sleeping. It was very challenging but also an incredibly rewarding experience.

Think you're up for the challenge?

The next call for participants will be this month to attend the 2018 class in the Netherlands.

For more information, visit www.isunet.edu/about/space-studies-program



NOAA's Geostationary Operational Environmental Satellite-S, or GOES-S, is rotated from horizontal to vertical for the start of prelaunch processing activities at Astrotech Space Operations in Titusville, Florida, near Kennedy. GOES-S is the second in a series of four advanced geostationary weather satellites. It is slated to launch March 1 aboard a United Launch Alliance Atlas V rocket from Cape Canaveral Air Force Station. Photo credit: NASA/Kim Shiflett

Fond Farewell

Engineering director retires after 34 years of service

BY LINDA HERRIDGE

During his years at NASA Kennedy Space Center, Engineering Director Pat Simpkins always embraced a leadership philosophy that included passion, energy, curiosity and a sense of humor along the way.

“Working for NASA has allowed me to exercise all four of these philosophies,” Simpkins said.

After more than 34 years with the agency, three of them at NASA Headquarters, Simpkins retired on Dec. 31, 2017.

Though his original goal was to work for the Environmental Protection Agency, he saw an ad for a position in environmental control systems at Kennedy while he was working as an assistant manager at Captain D’s in Titusville. “I weighed my options for about two seconds and applied for that position,” Simpkins said. “The rest is history.”

Simpkins began his career with NASA in 1983 as a space shuttle environmental control and life support systems engineer. He was a lead test engineer on the manned maneuvering unit for the first nontethered in-space extravehicular activity, troubleshooting problems and providing technical leadership through his presence in the Launch Control Center for more than 120 space shuttle missions.

Several years later, he became chief of the Shuttle Processing Engineering Fluid Systems Division. His managerial strengths were recognized, and he was assigned the role of Kennedy’s Personnel Officer. In that role, Simpkins developed the Leadership Excellence Achievement Program (LEAP), which is still going strong today.

At Kennedy, he formed the first knowledge management working group in the agency and developed the agency’s first competency management system. Simpkins led the workforce planning function for the reorganization known as “KSC 2000,” an effort that moved the center into a new era of research and technology development.

While working on a reassignment in the Senior Executive Service Candidate Development Program at NASA Headquarters in Washington, D.C., in 2001, Simpkins led a variety of agency-level Human Resources information management initiatives for the Office of Human Capital Management. He implemented an agencywide competency management system that was used to assess agency workforce capabilities after the space shuttle Columbia accident. He also led a team of center directors and associate administrators to develop and implement a Strategic Human Capital Plan.

He returned to Kennedy as the director of Human Resources. He led the design, development and implementation of the reorganization of the spaceflight engineering workforce, the first of its kind at the center in more than 40 years. The reorganization helped provide technical excellence to NASA spaceflight programs and expanded



NASA Kennedy Space Center’s Engineering Director Pat Simpkins signed the banner Dec. 8, 2017, marking the successful delivery of a liquid oxygen test tank, called Tardis, in the Prototype Development Laboratory at NASA’s Kennedy Space Center. Engineers and technicians worked together to develop the tank and build it to support cryogenic testing at Johnson Space Center’s White Stands Test Facility in Las Cruces, New Mexico. The 12-foot-tall, 3,810-pound aluminum tank will be shipped to White Sands for testing. Photo credit: NASA/Cory Huston

Kennedy’s normally ground-based role into spaceflight hardware design and operations.

Simpkins led the efforts to design and develop the center’s Engineering Directorate in 2006. He was the first director of that organization. He became its director again in 2015, after spending two years in Ground Processing.

“I have thrived here at NASA, not because of who I am or what little I know, but because of the people I have been blessed to come to know,” Simpkins said. “In the local vernacular, ‘GO Exploration! GO NASA! And keep GOING KSC!’”

Simpkins is the recipient of the Exceptional Service Medal, the NASA Astronauts’ Silver Snoopy Award, the President’s Meritorious Rank Award, and many others.

He has a bachelor’s degree in environmental engineering from the University of Florida in Gainesville, Florida, and a master’s in human resource management from the Florida Institute of Technology in Melbourne, Florida. He earned his doctorate in business administration from Nova Southeastern University.

Simpkins also is a graduate of the Human Resources Executive Program at the University of Michigan and was a Harvard Senior Executive Fellow.

He resides in Merritt Island with his wife (and former high school sweetheart) of more than 25 years, Beth. Their son, Dainius, is in his second year of law school.



Patrick Simpkins enjoys a relaxing moment in his office as he reflects on his NASA career. Photo credit: NASA/Glenn Benson



Our Refuge

NASA'S KENNEDY SPACE CENTER
NATIONAL WILDLIFE REFUGE

Feral hogs are one of the best-known species of animals present at Kennedy. Unfortunately, they also are one of our biggest environmental challenges and safety problems. In this edition of our Q&A series, we look at the impacts that hogs have on the space center's ecology, how and why these impacts happen and what is being done to reduce them.



Wild hogs forage for food in tall grass at NASA's Kennedy Space Center. Photo credit: NASA/Bill White

1. How many hogs live on Kennedy property?

No one really knows for sure how many hogs are here. Estimates over the years have ranged between 3,000 and 12,000, and establishing a specific number is impossible. However, a study to determine hog population trends currently is being designed that will provide information needed for hog management.

2. How did the hogs get here?

The hogs are descendants of captive animals that belonged to people who lived in this area before it became Kennedy Space Center.

3. Why are the hogs considered to be an environmental problem?

Hogs are an exotic, invasive species that do incredible damage to native habitats and wildlife. They can devastate lawns, road shoulders and wetlands by rooting. Eggs and animals that are hidden in the soil also are eaten by hogs. Their urination and defecation impact the water quality in our small, seasonal wetlands, which in turn is detrimental to vegetation and wildlife. Hogs are a human safety hazard as well, and there is an average of one hog/vehicle interaction reported on center property each week. Hogs also can transmit a number of diseases to humans, including swine brucellosis and tularemia.

4. Why is the center's hog population so large?

Hogs are as good as rabbits at reproducing! They typically begin having piglets when they are less than a year old, and can produce five to seven piglets twice a year. They eat a very wide variety of readily available food, so their reproductive potential is very high. Over a sow's four-to-five-year lifespan, that can result in a whole lot of hogs.

5. Is there a difference between pigs, hogs and wild boars?

No. All pigs, hogs and boars are the same species, *Sus scrofa*. The different common names developed over time and are based on where the pig lives (farm vs. unconfined in nature). Biologically, they are very similar.



A cattle egret watches as a hog roots for food near a waterway at Kennedy Space Center. Photo credit: NASA/Bill White

6. What is being done about Kennedy's feral hog problem?

Hog control at Kennedy began in 1972 and has evolved into a very significant effort since that time. The Merritt Island National Wildlife Refuge currently contracts five professional trappers that have 45 authorized agents. The trappers are allowed to capture hogs using live traps. All hogs must be taken off of the

refuge alive, become the property of the trapper (that is their only pay), and must be disposed of legally. The trapping program's goal is to protect human safety and center infrastructure from hog damage. The trappers concentrate their efforts in areas near roads and around facilities, and they respond to specific damage reports. Between 2,000 and 2,500 hogs are removed from the refuge each year.

7. Are there public hog hunts on KSC?

There are a few hogs taken each year in association with the [Merritt Island Refuge quota deer archery hunt](#), but this is for recreation and is not an effective population control method. No hunting is allowed within the Kennedy security boundaries.

8. Why are hogs such a difficult problem to address?

Many factors contribute to the problems we have with hogs. According to Psychology Today, hogs are intelligently, emotionally and cognitively complex. The sows and young travel together, so they learn from watching each other and are difficult to trap. Because hogs don't sweat, they tend to be most active here at night, and their typically dark color and lack of eye shine can make them difficult to find. They also inhabit upland and wetland habitats, as well as developed areas such as lawns and roadsides. All of those factors combine to make hogs very efficient, destructive and "hard-to-find-and-eliminate" machines.

9. How can I help?

The most important thing you can do to help with hog control is to report groups of hogs or areas of rooting to the KSC Duty Office (861-5050). Knowing the specific places that the hogs are using helps trappers deal with them quickly and efficiently, and the Duty Office will convey the necessary information to the right people.

Technicians and engineers inspect NOAA's Geostationary Operational Environmental Satellite-S, or GOES-S, at Astrotech Space Operations in Titusville, Florida, near Kennedy Space Center. GOES-S is the second in a series of four advanced geostationary weather satellites. It is slated to launch March 1 aboard a United Launch Alliance Atlas V rocket from Cape Canaveral Air Force Station. Photo credit: NASA/Leif Heimbold



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